FORM PTO-1390 (REV 10-2000)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER: CU-2604 RJS

U.S. APPLICATION NO. (If known, see 37 CFR 1.5): 09/890307

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/AU99/00056	28 January 1999	

TITLE OF INVENTION: NOISE SUPPRESSION IN LIGHTWAVE COMMUNICATION SYSTEMS

APPLICANT(S) FOR DO/EO/US: Hongbing GAN et al

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. [X] This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. [ ] This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. [X] This is an express request to promptly begin national examination procedures (35 U.S.C. 371(f)).
4. [X] The US has been elected by the expiration of 19 months from the priority date (PCT Article 31).
5. [X] A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. [X] is attached hereto (required only if not communicated by the International Bureau).
   b. [ ] has been communicated by the International Bureau.
   c. [ ] is not required, as the application was filed in the United States Receiving Office (RO/US).
6. [ ] An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
7. [X] Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. [ ] are attached hereto (required only if not communicated by the International Bureau).
   b. [ ] have been communicated by the International Bureau.
   c. [ ] have not been made; however, the time limit for making such amendments has NOT expired.
   d. [X] have not been made and will not be made.
8. [ ] An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. [ ] An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. [ ] An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 16 below concern document(s) or information included:

11. [ ] An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. [ ] An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. [X] A FIRST preliminary amendment.
    [ ] A SECOND or SUBSEQUENT preliminary amendment.
14. [ ] A substitute specification.
15. [ ] A change of power of attorney and/or address letter.
16. [ ] Other items or information:

Express Mail Label No.:
EL698181836US

U.S. APPLICATION NO. (if known, see 37 CFR 1.5)	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
09/890307	PCT/AU99/00056	CU-2604 RJS

17. [x] The following fees are submitted:	CALCULATIONS PTO USE ONLY
BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :	
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO **$1000.00**	
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO **$860.00**	
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO **$710.00**	
International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) **$690.00**	
International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) **$100.00**	

ENTER APPROPRIATE BASIC FEE AMOUNT =				$ 1000.00	
Surcharge of **$130.00** for furnishing the oath or declaration later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 CFR 1.492(e)).				$	
CLAIMS	NUMBER FILED		NUMBER EXTRA	RATE	
Total claims	15	- 20 =	0	X **$18.00**	$
Independent claims	2	- 3 =	0	X **$80.00**	$
MULTIPLE DEPENDENT CLAIM(S) (if applicable)				+ **$270.00**	$
TOTAL OF ABOVE CALCULATIONS =				$ 1000.00	
[ ] Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.				$	
SUBTOTAL =				$ 1000.00	
Processing fee of **$130.00** for furnishing the English translation later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 CFR 1.492(f)). +				$	
TOTAL NATIONAL FEE =				$	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property +				$	
TOTAL FEES ENCLOSED =				$ 1000.00	
				Amount to be refunded:	$
				charged:	$

a. [x] A check in the amount of $ 1000.00 to cover the above fees is enclosed.

b. [ ] Please charge my Deposit Account No. _____ in the amount of $_____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. [x] The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 12-0400. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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July 27, 2001

SIGNATURE:

Richard J. Streit
NAME

25765
REGISTRATION NUMBER

DOCKET: CU-2604

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

APPLICANT: Hongbing GAN et al)
)
TITLE: NOISE SUPPRESSION IN LIGHTWAVE COMMUNICATION SYSTEMS)
)
COMPLETION OF PCT/AU99/00056 filed 28 January 1999)

The Commissioner for Patents (DO/EO/US)
Box PCT
Washington, D.C. 20231

PRELIMINARY AMENDMENT

Dear Sir:

Please amend this application as follows:

IN THE CLAIMS:

Please substitute the clean version of claim page 9 attached herewith in place of original claim page 9. A marked version of claim page 9 is also attached herewith indicating the changes made therein.

REMARKS

The aforesaid amendments have been made to place the claims in better condition for examination under U.S. rules of practice.

Respectfully submitted,

July 27, 2001
Date

/36

Attorney for Applicant

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in claim 8 wherein said mechanical oscillator oscillates at a frequency in the range of 300Hz to 40Khz.

10. An optical communications system as claimed in claim 8 wherein said mechanical oscillator oscillates at a frequency in the range of 300Hz to 2500Hz.

11. An optical communications system as claimed in claim 7 wherein said mechanical modulator is in contact with said optical waveguide.

12. An optical communications system as claimed in claim 7 herein said mechanical modulator emits an audio signal in the presence of said optical waveguide.

13. An optical communications system as claimed in claim 7 herein said mechanical modulator interacts with an initial portion of said optical waveguide substantially adjacent said interconnection with said laser.

14. An optical communications system as claimed in claim 7 wherein said optical waveguide comprises an optical fibre and further includes a portion of an optical fibre having an offset core and said mechanical modulator perturbs said portion.

15. An optical communications system as claimed in claim 14 wherein said portion is bent into a coil.

in claim 8 wherein said mechanical oscillator oscillates at a frequency in the range of 300Hz to 40Khz.

10. An optical communications system as claimed in claim 8 wherein said mechanical oscillator oscillates at a frequency in the range of 300Hz to 2500Hz.

11. An optical communications system as claimed in ~~any of~~ claim 7 ~~to claim 10~~ wherein said mechanical modulator is in contact with said optical waveguide.

12. An optical communications system as claimed in ~~any of~~ claim 7 ~~to claim 10~~ herein said mechanical modulator emits an audio signal in the presence of said optical waveguide.

13. An optical communications system as claimed in claim 7 herein said mechanical modulator interacts with an initial portion of said optical waveguide substantially adjacent said interconnection with said laser.

14. An optical communications system as claimed in claim 7 wherein said optical waveguide comprises an optical fibre and further includes a portion of an optical fibre having an offset core and said mechanical modulator perturbs said portion.

15. An optical communications system as claimed in claim 14 wherein said portion is bent into a coil.

16. An optical fibre communications system substantially as hereinbefore describe with reference to the accompanying drawings.

NOISE SUPPRESSION IN LIGHTWAVE COMMUNICATION SYSTEMS

Field of the Invention

The present invention relates to optical fibre communications systems and in particular, discloses a method of suppressing noise in an optical fibre communications system.

Background of the Invention

In optical fibre telecommunications systems, a laser is modulated with a transmission signal with the output of the laser being fed over an optical fibre of quite some distance. At the end of the optic fibre a receiver is placed for receiving and decoding the transmitted signal.

Due to Rayleigh Backscattering (RB) from the fibre system (See K.D. Laviolette, "The impact of Rayleigh Backscatter induced noise on QPSK transmission with Fabry-Perot lasers' IEEE Photon. Technol. Lett., Vol 10, no. 11, pp 1644-1646, Nov 1998."), it is often the case that the fibre waveguide provides for optical feedback to the laser system which can in turn, in common with discreet reflections, introduce an instability in the laser and thereby degrade system performance. The presence of Rayleigh Backscattering normally requires the utilization of an optical isolator so as to isolate the feedback from the lazing system. The utilizing of optical isolators can dramatically increase the cost of an optical fibre telecommunications system.

It would be desirable to substantially reduce the effects of Rayleigh Backscattering without the need to utilize an optical isolator.

Summary of the Invention

In accordance with a first aspect of the present invention, there is provided in an optical fibre lasing system including a feedback laser system interconnected with an optical waveguide, such as an optical fibre, a method of reducing the feedback effects from Rayleigh backscattering comprising the step of: subjecting portions

of the optical waveguide to low frequency mechanical vibration so as to reduce feedback from Rayleigh backscattering of the optical waveguide.

The low frequency mechanical vibration can comprise a continuous oscillation in the range of 300Hz to 2500Hz or 300Hz to 40KHz.

The mechanical vibration of the optical waveguide preferably occurs substantially adjacent to the interconnection with the laser system.

In accordance with a further aspect of the present invention, there is provided an optical communications system comprising a laser source; an optical waveguide interconnected to the laser source to carry an optical signal from the source to an optical receiver; an optical receiver interconnected to the optical waveguide for decoding the signal; and a mechanical modulator adapted to substantially continuously mechanically perturb a portion of the optical waveguide so as to reduce Rayleigh backscattering from the optical waveguide.

The mechanical modulator can be in contact with the optical waveguide or the mechanical modulator can emit an audio signal in the presence of the optical waveguide. The mechanical modulator preferably interacts with an initial portion of the optical waveguide substantially adjacent the interconnection with the feedback laser.

The optical waveguide can comprise an optical fibre and further preferably can include a portion having an offset core with the mechanical modulator perturbing the portion.

Brief Description of the Drawings

Notwithstanding any other forms which may fall within the scope of the present invention, preferred forms of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Fig. 1 illustrates schematically the arrangement of a first embodiment of the present invention;

Fig. 2 illustrates the laser output power

frequency spectrum (with a 2MHz resolution bandwidth) with and without the present invention;

Fig. 3 illustrates the Rayleigh backscatter power with respect to time, with and without the present invention;

Fig. 4 illustrates the Rayleigh backscatter power frequency spectrum (with a 2MHz resolution bandwidth) with and without the present invention;

Fig. 5 illustrates an alternative embodiment;

Fig. 6 illustrates the utilization of an offset core fibre in an alternative embodiment.

Description of Preferred and Other Embodiments

In a first embodiment, the Rayleigh Backscattering feedback is suppressed through the utilization of an audio frequency external optical phase modulation. The result is the suppression of the noise tones and the restoration of the laser linewidth. The utilization of the audio frequency modulation allows for effective operation of Fabry-Perot lasers without utilization of an optical isolator.

A first example embodiment was constructed in accordance with the arrangement 1 as illustrated in Fig. 1. A Fujitsu FLD150C2KM 1550-nm Fabry-Perot laser 2 was biased with 25-mA dc current and generated -2.5 dBm optical power. Its output was coupled to port 1 of a 50/50 coupler 3 via 400m of standard single-mode fibre (SMF) 4. Port 2 of the coupler was fusion spliced to 10km of standard SMF 5 with the fibre's far end 6 immersed in index matching gel to suppress Fresnel reflection; thus RB was the dominant feedback to the unisolated FP laser 2. Port 3 of the coupler was used to monitor the RB using power meter 8. Port 4 of the coupler was used to monitor the laser output using an isolator 9, a receiver 10 and spectrum analyzer 11

Firstly, the effects of RB on the unisolated laser were measured. The RF spectrum of the laser output is shown 15 in Fig. 2 and showed random frequency tones as high as 20 dB above the noise floor from dc to 500 MHz when

the laser was subject to RB. The "maxholding" function of the spectrum analyzer was used for one minute. To show that these random frequency tones were caused by RB, a 15-dB bending loss was applied at the transmission end of the 10-km fibre and this removed these tones. These tones are thought to be ascribed to mode hopping between laser modes created by the laser cavity locking to the Rayleigh backscatter external distributed cavity. This distributed cavity is through to result from a superposition of the reflections from the many scattering centres. The erratic nature of the backscatter causes changes in this external distributed cavity and causes a transition to occur within the laser cavity as it follows these changes. During a transition, the laser is thought to have two lasing frequencies, and the RF tones are caused by the mixing of these at the photodiode detector. The laser linewidth was estimated to be around 1 kHz by measuring the width of RF tones when the laser was subject to RB. Large linewidth narrowing might be explained as the RB establishes a narrow bandwidth reflection. The laser locks to this reflection and then has a very narrow linewidth due to the long effective cavity. The absolute power level of the RB monitored from port 3 is shown 16 in Fig. 3 and fluctuated on a time-scale comparable to 1 sec.

Secondly, a 0.25-W loudspeaker 17 seated on the fibre spool 4 was driven by a 500-Hz 150-mA electrical signal. The electrical input power was 180mW and the generated audio output power was 58 dB. It is thought that, when an acoustic wave is incident on the fibre, the resulting changes in Fibre length, diameter and refractive index cause a variation in optical phase due to the photoelastic effect. Thus the laser output is optical-phase modulated by the acoustic wave, as was the backscattered light. Under the optical-phase modulation, the RF spectrum of laser output showed no RF tones as shown 19 in Fig. 2 measured at port 4 of the coupler. The RF spectrum of RB, as shown in Fig. 4, was measured at port 3

of the coupler. The first plot 20 shows the RF spectrum of the RB without the presence of phase modulation. In this case the laser linewidth is too small to be directly measured, but the RF tone bursts 21 caused by the backscatter of two coexisting narrow linewidth laser outputs beating at the receiver can be seen. The laser goes to a free running laser 22 when the phase modulation was present. The RF spectrum of RB (showing laser linewidth because RB is interferometric multipath signal) indicated that linewidth-narrowing was also suppressed; the laser linewidth increased to 110 MHz. As shown 23 in Fig. 3, the RB power monitored from port 3 was reduced by 3 dB to -41 dBm and the second time-scale power fluctuation disappeared.

Finally, an optical isolator was inserted immediately after the FP laser to prevent RB from entering the laser. With the isolator in placed, it was observed that the RF spectrum, linewidth and power level were substantially the same as when the fibre was optical-phase modulated by an acoustic wave. Thus the acoustic (optical-phase) modulation mimics the optical isolator in suppressing the unwanted interaction between the RB and the laser, which causes the RF noise tones.

In an alternative embodiment, a shorter length of fibre was utilized and an attempt made to directly couple the acoustic vibrations into the fibre. An example of this embodiment is shown schematically in Fig. 5 wherein a speaker 30 was directly coupled to a short length of fibre 31 which was fixed 32, 33 around the speaker 30. The fibre 31 was held very taught between the fixing points 32, 33 and a lip of the speaker 30. The fibre 31 included a standard 900 micron coating for protection. The arrangement of Fig. 5 was found to successfully suppress RF tones utilizing acoustic frequencies from 300Hz to 2500Hz. Further operation up to 17KHz was also found to suppress RF tones.

Often the optimum frequency to drive the acoustic

wave at will be the resonant frequency of the total arrangement of Fig. 5. If a particular acoustic frequency is required than the fibre/speaker assembly can be appropriately designed.

It will therefore be evident that the foregoing embodiments include an external bending or stretching of the fibre to modulate the refractive index at a lower frequency. The stretching arrangement of Fig. 5 often requires considerable attention to achieve and the set up can be unduly complicated in trying to ensure that the fibre does not slip. In practice, the easiest approach is to vibrate the fibre by bending it around the speaker. However the phase changes can still be very small although the mechanical energy required to bend a fibre is also very small.

One way to substantially enhance the response to bending is to utilize an offset core fibre.

In bending a standard fibre with a concentric core, the first order response is zero because compression on one side of the core is balanced by expansion on the other. If the core is displaced away from the centre by at least one core diameter (ca 10 microns), then a first order response is obtained since all the core is in compression or expansion at the same time. The index change is substantially polarisation independent as the stress is axial.

Turning to Fig. 6, there is illustrated a single mode optical fibre 40 having an offset core 41 offset a length D from a central axis, with the fibre being bent with a radius R. The index change increases with the offset D and with the inverse of the bend radius R. Through the utilization of a offset core fibre in the arrangement of Fig. 5, substantial enhancements can be achieved. Of course other forms of mechanical oscillator could be used. For example, piezoelectric oscillators or other forms of micro mechanical oscillators could be utilized.

The foregoing embodiments can be implemented in a optical fibre communications network as part of a new network deployment or as a refitting of an old network to improve an existing network that is operating in an unisolated manner. In an old network, it may be part of the constraints that no breaking or resplicing of the current fibre can be undertaken. In this example, the arrangement of Fig. 5 can be utilized with an axial core fibre.

Where a stand alone device is to be provided then a device having an offset core fibre can be provided for splicing into the relevant portions of a communication network as a "retro-fitted' device otherwise an acoustic modulation of the inplace fiber may be provided without the need for a splicing of the network and without the necessity for shutting down the network for the period of instalment.

It would be appreciated by a person skilled in the art that numerous variations and/or modifications may be made to the present invention as shown in the specific embodiments without departing from the spirit or scope of the invention as broadly described. The present embodiments are, therefore, to be considered in all respects to be illustrative and not restrictive.

We Claim:

1. In an optical fibre lasing system including a laser system interconnected with an optical waveguide, a method of reducing the feedback effects from Rayleigh backscattering comprising the step of:

subjecting portions of said optical waveguide to low frequency mechanical vibration so as to reduce feedback from Rayleigh backscattering of said optical waveguide.

2. A method as claimed in claim 1 wherein said low frequency mechanical vibration comprises a continuous oscillation.

3. A method as claimed in claim 2 wherein said low frequency is in the range of 300Hz to 1200Hz.

4. A method as claimed in claim 2 wherein said low frequency is in the range of 300Hz to 40KHz.

5. A method as claimed in claim 1 wherein said optical waveguide comprises an optical fibre.

6. A method as claimed in claim 1 wherein said mechanical vibration of said optical waveguide occurs substantially adjacent is interconnection with said laser system.

7. An optical communications system comprising:

a laser source;

an optical waveguide interconnected to said laser source to carry an optical signal from said source to an optical receiver;

an optical receiver interconnected to said optical waveguide for decoding said signal;

a mechanical modulator adapted to substantially continuously mechanically perturb a portion of said optical waveguide so as to reduce Rayleigh backscattering from said optical waveguide.

8. An optical communications system as claimed in claim 7 wherein said mechanical modulator comprises a mechanical oscillator.

9. An optical communications system as claimed

in claim 8 wherein said mechanical oscillator oscillates at a frequency in the range of 300Hz to 40Khz.

10. An optical communications system as claimed in claim 8 wherein said mechanical oscillator oscillates at a frequency in the range of 300Hz to 2500Hz.

11. An optical communications system as claimed in any of claim 7 to claim 10 wherein said mechanical modulator is in contact with said optical waveguide.

12. An optical communications system as claimed in any of claim 7 to claim 10 herein said mechanical modulator emits an audio signal in the presence of said optical waveguide.

13. An optical communications system as claimed in claim 7 herein said mechanical modulator interacts with an initial portion of said optical waveguide substantially adjacent said interconnection with said laser.

14. An optical communications system as claimed in claim 7 wherein said optical waveguide comprises an optical fibre and further includes a portion of an optical fibre having an offset core and said mechanical modulator perturbs said portion.

15. An optical communications system as claimed in claim 14 wherein said portion is bent into a coil.

16. An optical fibre communications system substantially as hereinbefore describe with reference to the accompanying drawings.

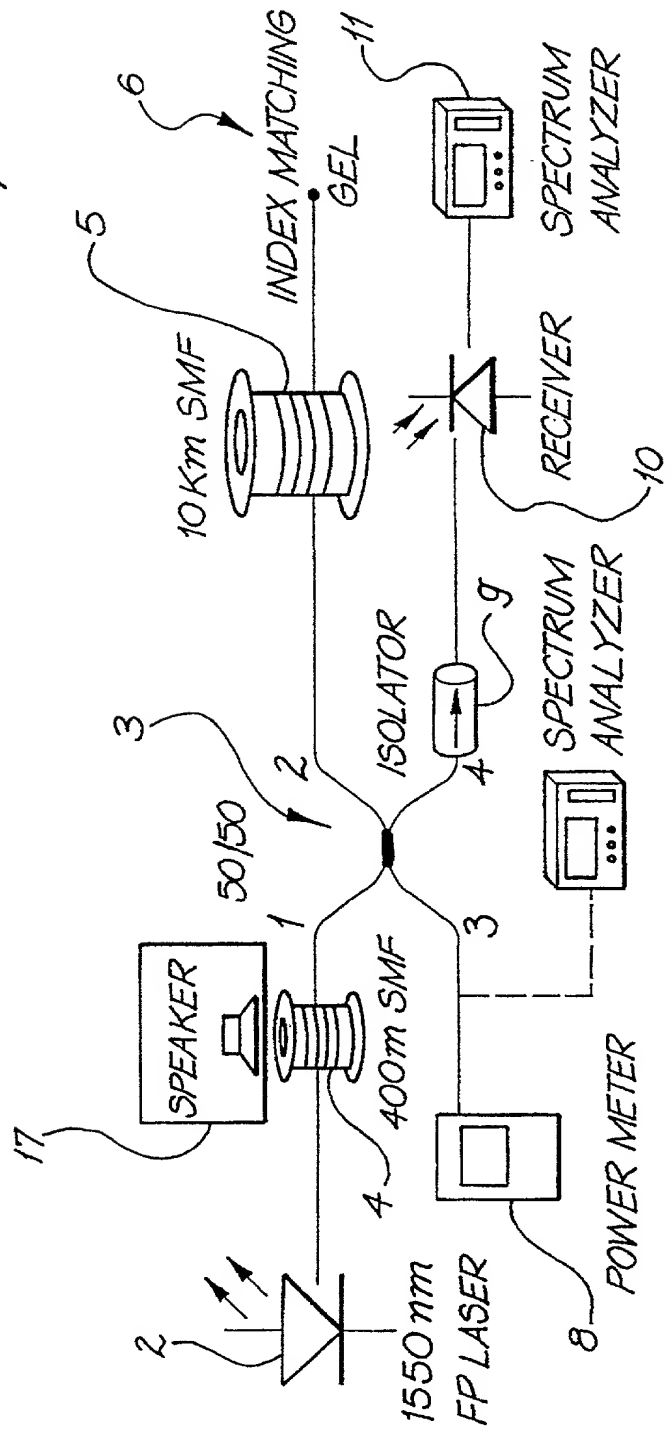
1
6
INDEX MATCHING GEL
11
SPECTRUM ANALYZER
5
10 Km SMF
RECEIVER
10
3
2
ISOLATOR
9
SPECTRUM ANALYZER
4
50/50
1
3
SPEAKER
400m SMF
17
4
2
1550 nm FP LASER
8
POWER METER

FIG. 1

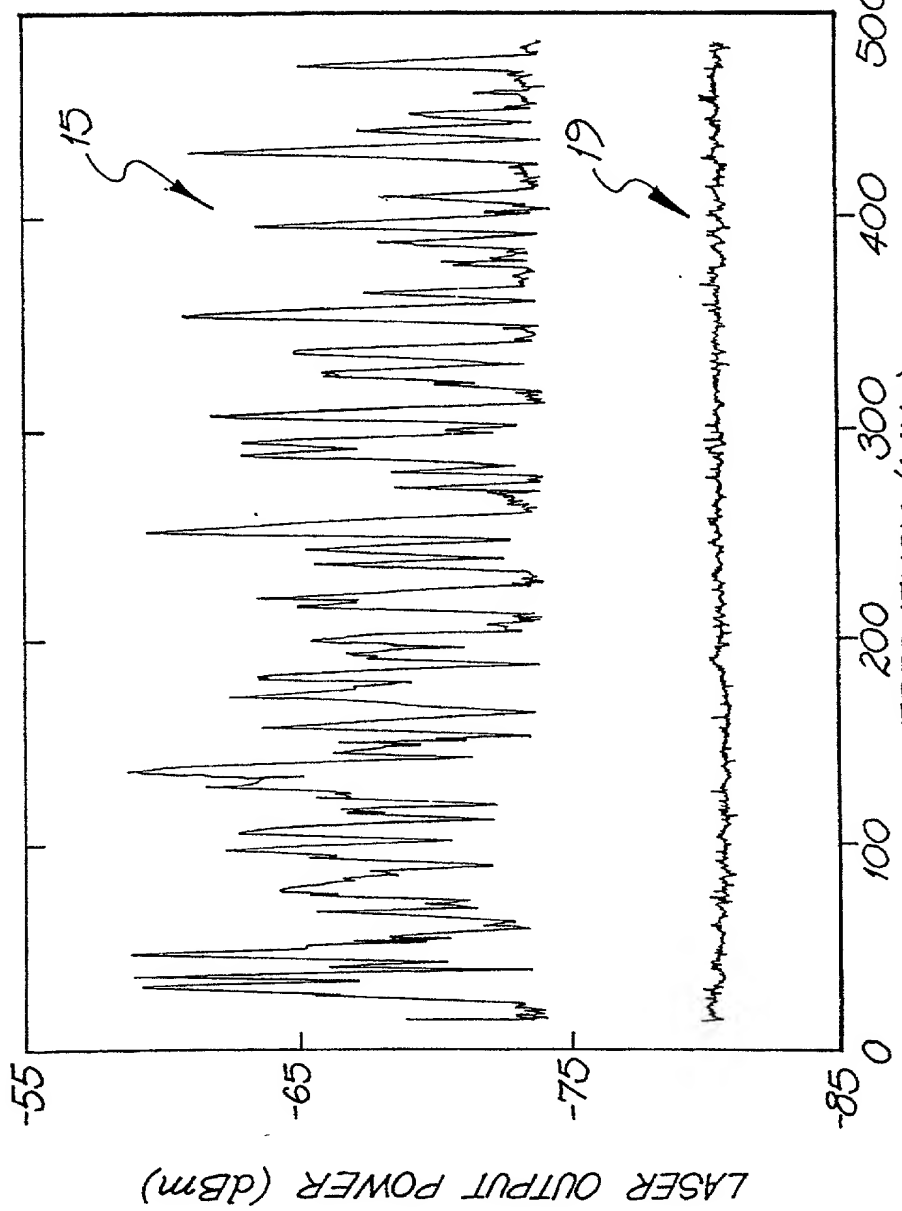
15
19
-55
-65
-75
-85
0
100
200
300
400
500
FREQUENCY (MHz)
LASER OUTPUT POWER (dBm)

FIG. 2

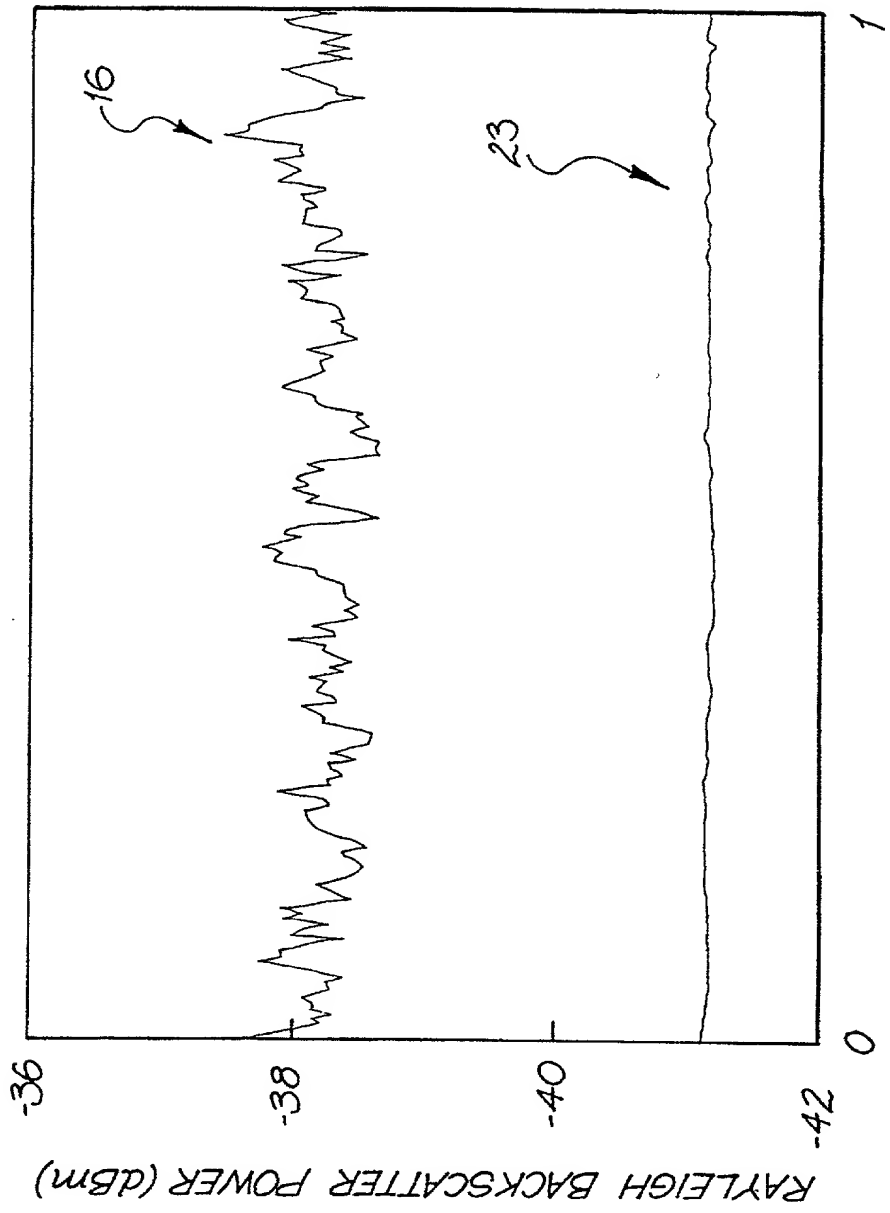

FIG. 3

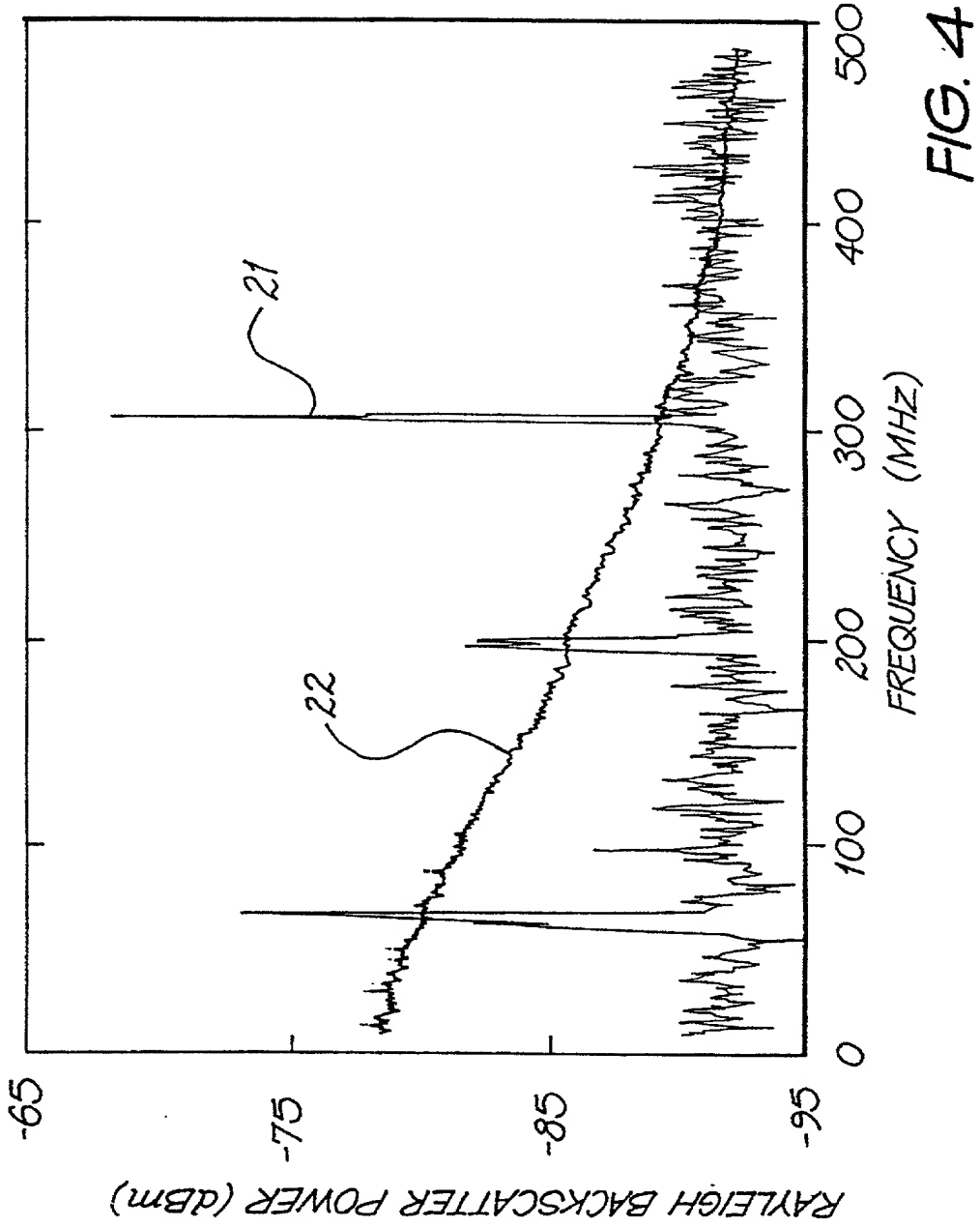

FIG. 4

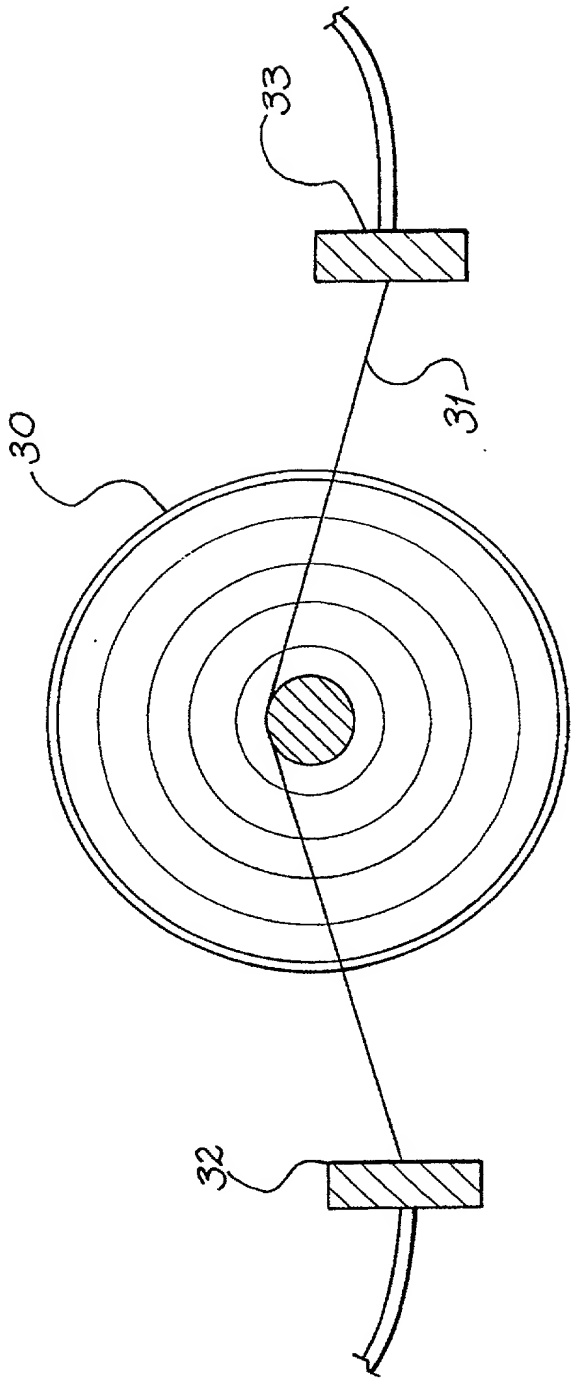

FIG. 5

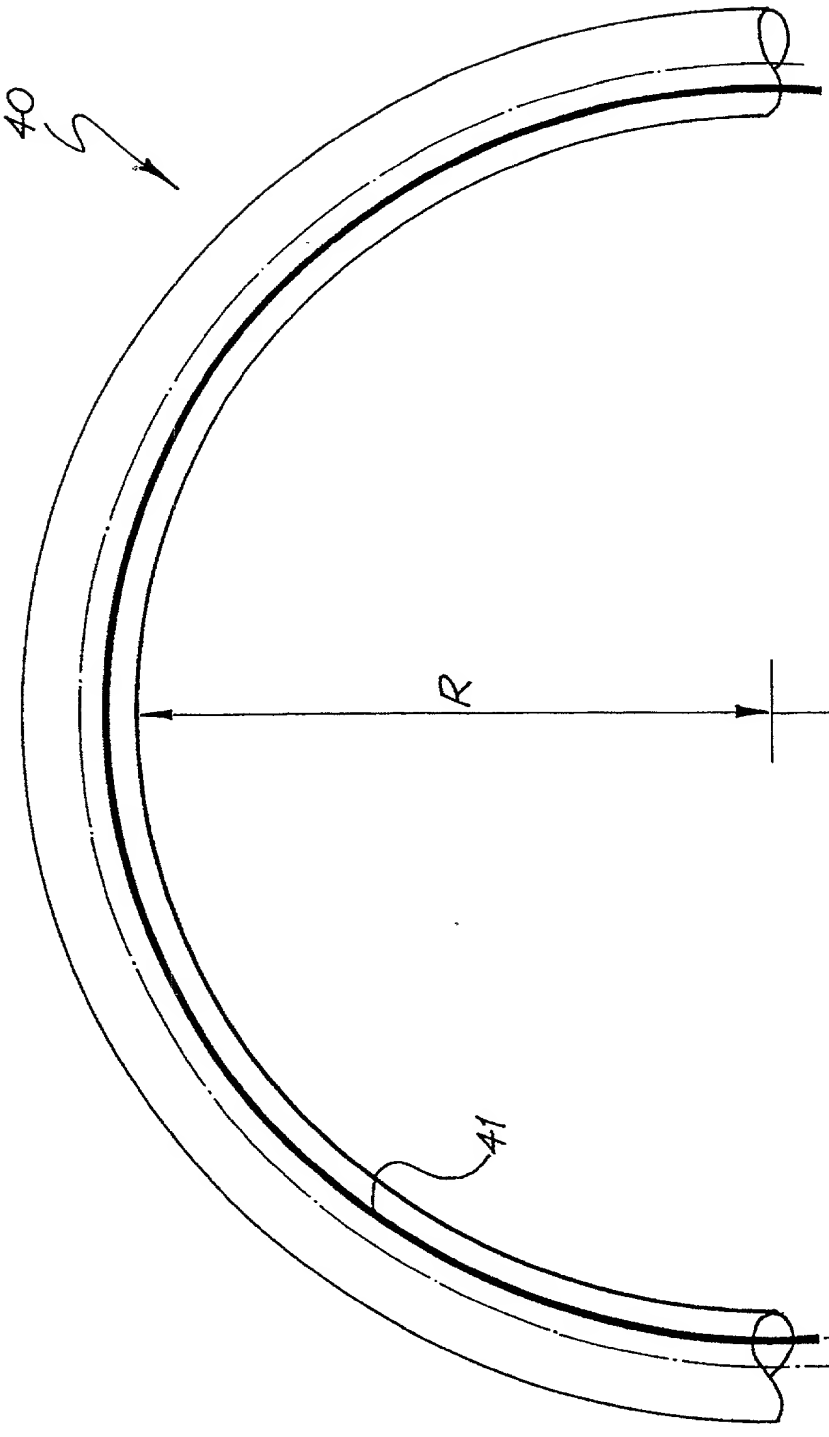

FIG. 6

DOCKET: CU-2604

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

APPLICANT: Hongbing GAN et al

SERIAL NO: 09/890,307

TITLE: NOISE SUPPRESSION IN LIGHTWAVE COMMUNICATION SYSTEM

COMPLETION OF PCT/AU99/00056 filed 28 January 1999

The Commissioner for Patents
Washington, D.C. 20231

APPOINTMENT OF ASSOCIATE ATTORNEYS

Dear Sir:

The undersigned Attorney for Applicant in the above identified application for Letters Patent, hereby appoints individually and collectively as my Associate Attorneys, to prosecute this application, to make alterations and amendments therein, to receive the patent, and to transact all business in the Patent & Trademark Office connected therewith:

Donald P. Reynolds, Reg. 26220
W. Dennis Drehkoff, Reg. 27193
Vangelis Economou, Reg. 32341
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October 30, 2001
Date

Attorney for Applicant

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us\forms\asocaty.doc/1

ADDED PAGE TO COMBINED DECLARATION AND POWER OF ATTORNEY FOR SIGNATURE BY FOURTH AND SUBSEQUENT INVENTORS

400

Full name of fourth joint inventor, if any

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Inventor's signature [signature]

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Post Office Address

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Inventor's signature

Date **Country of Citizenship**

Residence

Post Office Address

Full name of sixth joint inventor, if any

(Given Name) | (Middle Initial or Name) | (Family (or Last) Name)

Inventor's signature

Date **Country of Citizenship**

Residence

Post Office Address

SIGNATURE(S)

Note: Carefully indicate the family (or last) name, as it should appear on the filing receipt and all other documents.

100 **Full name of sole or first inventor**

Hongbing | | GAN
(Given Name) (Middle Initial or Name) (Family (or Last) Name)

Inventor's signature

Date 22nd, October, 2001 **Country of Citizenship** Chinese

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200 **Full name of second joint inventor, if any**

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(Given Name) (Middle Initial or Name) (Family (or Last) Name)

Inventor's signature

Date 15th October 2001 **Country of Citizenship** ~~United~~ Kingdom

Residence ~~136 Derby Street Kew VIC 3101 AUSTRALIA~~

Post Office Address

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300 **Full name of third joint inventor, if any**

Richard | David | LAUDER
(Given Name) (Middle Initial or Name) (Family (or Last) Name)

Inventor's signature

Date **Country of Citizenship** United Kingdom

Residence ~~1/12 Fulham Road Alphington VIC 3078 AUSTRALIA~~

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AWY.

CLAIM FOR BENEFIT OF PRIOR U.S. PROVISIONAL APPLICATION(S) (34 U.S.C. § 119(e))

I hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s) listed below:

PROVISIONAL APPLICATION NUMBER	FILING DATE

ALL FOREIGN APPLICATION(S), IF ANY, FILED MORE THAN 12 MONTHS (6 MONTHS FOR DESIGN) PRIOR TO THIS U.S. APPLICATION

Note: *If the application filed more than 12 months from the filing date of this application is a PCT filing forming the basis for this application entering the United States as (1) the national stage or (2) a continuation, divisional, or continuation-in-part, then also complete ADDED PAGES TO COMBINED DECLARATION AND POWER OF ATTORNEY FOR DIVISIONAL, CONTINUATION OR CIP APPLICATION for benefit of the prior U.S. or PCT application(s) under 35 U.S.C. § 120.*

POWER OF ATTORNEY

I hereby appoint the following practitioner(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith *(list name and registration number)*.

Thomas F. Peterson, 24790; Richard J. Streit, 25765; Timothy J. Keefer, 35567; Dennis K. Scheer, 39356; Douglas S. Rupert, 44434; Steven L. Schmid, 39358; Paul B. West, 18947; Joseph H. Handelman, 26179; Peter D. Galloway 27885; John Richards, 31503; Iain C. Baillie, 24090; Richard P. Berg, 28145

☐ Attached, as part of this declaration and power of attorney, is the authorization of the above-named practitioner(s) to accept and follow instructions from my representative(s).

SEND CORRESPONDENCE TO:

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224 South Michigan Avenue
Chicago, Illinois 60604

DIRECT TELEPHONE CALLS TO:
(Name and telephone number)

(312) 427-1300

DECLARATION

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

ACKNOWLEDGEMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information, which is material to patentability as defined in 37, Code of Federal Regulations, § 1.56,

(also check the following items, if desired)

☐ and which is material to the examination of this application, namely, information where there is a substantial likelihood that a reasonable Examiner would consider it important in deciding whether to allow the application to issue as a patent, and

☐ in compliance with this duty, there is attached an information disclosure statement, in accordance with 37 CFR 1.98.

PRIORITY CLAIM (35 U.S.C. § 119(a)-(d))

I hereby claim foreign priority benefits under Title 35, United States Code, § 119(a)-(d) of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

(complete (d) or (e))

☒ (d) no such applications have been filed.

☐ (e) such applications have been filed as follows.

Note: Where item (c) is entered above and the international application which designated the U.S itself claimed priority check item (e), enter the details below and make the priority claim.

PRIOR FOREIGN/PCT APPLICATION(S) FILED WITHIN 12 MONTHS (6 MONTHS FOR DESIGN) PRIOR TO THIS APPLICATION AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. § 119(a)-(d)

COUNTRY (OR INDICATE IF PCT	APPLICATION NUMBER	DATE OF FILING (day/month/year)	PRIORITY CLAIMED UNDER 35 USC 119
			☐ YES NO ☐
			☐ YES NO ☐
			☐ YES NO ☐
			☐ YES NO ☐
			☐ YES NO ☐

PRL 208 - US

PATENT

Docket:

COMBINED DECLARATION AND POWER OF ATTORNEY

(ORIGINAL, DESIGN, NATIONAL STAGE OF PCT, SUPPLEMENTAL, DIVISIONAL, CONTINUATION OR CIP)

As a below named inventor, I hereby declare that:

TYPE OF DECLARATION

This declaration is of the following type: *(check one applicable item below)*

- ☐ original
- ☐ design
- ☐ supplemental

Note: If the Declaration is for an International Application being filed as a divisional, continuation or continuation-in-part application, do not check next item; check appropriate one of last three items.

- ☒ national stage of PCT

Note: If one of the following 3 items apply, then complete and also attach ADDED PAGES FOR DIVISIONAL, CONTINUATION OR CIP.

- ☐ divisional
- ☐ continuation
- ☐ continuation-in-part (CIP)

INVENTORSHIP IDENTIFICATION

WARNING: If the inventors are each not the inventors of all the claims, an explanation of the facts, including the ownership of all the claims at the time the last claimed invention was made, should be submitted.

My residence, post office address and citizenship are as stated below, next to my name. I believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter that is claimed, and for which a patent is sought on the invention entitled:

TITLE OF INVENTION

Noise Suppression in Lightwave Communication Systems

SPECIFICATION IDENTIFICATION

the specification of which: *(complete (a), (b) or (c))*

- ☐ (a) is attached hereto.
- ☐ (b) was filed on _____ as ☐ Serial No. _____ or ☐ Express Mail No. *(as Serial No. not yet known)* _____ and was amended on _____ *(if applicable)*.

Note: Amendments filed after the original papers are deposited with the PTO that contain new matter are not accorded a filing date by being referred to in the Declaration. Accordingly, the amendments involved are those filed with the application papers or, in the case of a supplemental Declaration, are those amendments claiming matter not encompassed in the original statement of invention or claims. See 37 CFR 1.67.

- ☒ (c) was described and claimed in PCT International Application No. PCT/AU99/00056 filed on 28/01/99 and as amended under PCT Article 19 on _____ *(if any)*.